

CLAIMS

1. A surgical instrument comprising:

a shaft having at least one controllably flexible segment and a tool mounted at a distal end of the shaft, the tool being insertable into a subject;

a shaft mount drivably coupled to the shaft at a proximal end of the shaft, the shaft mount being drivably coupled to the tool through the shaft; and

a drive unit drivably coupled to the shaft mount, the drive unit being operable from a location remote from the subject to control flexure of the flexible segment so as to control disposition of the tool at an operative site.

2. The instrument of claim 1, wherein the shaft, the shaft mount, and the tool are constructed and arranged as a single piece disposable unit.

3. The instrument of claim 1, further comprising a receiver intercoupled with the drive unit, the shaft mount being readily mountable on the receiver for drivable intercoupling of the shaft mount with the drive unit.

4. The instrument of claim 3, wherein the drive unit is engageable with and disengageable from the receiver, the drive unit being portable.

5. The instrument of claim 1, wherein the shaft mount and the receiver are engageable with and disengageable from each other.

6. The instrument of claim 1, wherein the shaft, the shaft mount, and the tool are constructed and arranged as a single piece portable unit.

7. The instrument of claim 1, including a cabling pathway extending from the drive unit to the flexible segment, for actuation of controlled bending at the flexible segment by the drive unit.

8. The instrument of claim 1, including a cabling pathway extending from the drive unit to the tool, for actuation of the tool by the drive unit.

9. The instrument of claim 8, wherein the shaft supports the tool via a wrist, the wrist being pivotable.

10. The instrument of claim 1, wherein the flexible segment comprises a series of slots defining spaced ribs.

11. The instrument of claim 1, further comprising a receiver for engaging the shaft mount, the receiver supported by a carriage slideably engaging rails controlled to translate the shaft toward and away from the operative site.

12. The instrument of claim 1, wherein the shaft is an inner shaft, the instrument further comprising a guide shaft for coaxially receiving the inner shaft, the guide shaft capable of disposing the tool at the operative site.

13. The instrument of claim 12, wherein the guide shaft also has at least one flexible segment, the bending of which is remotely controllable.

14. The instrument of claim 1, wherein the shaft is remote controllably drivable by a user via a manually controllable input device remote from the subject.

15. A remotely controllable surgical instrument, comprising:

a user input device, for inputting a command;

a slave station for receiving the command from the input device, the user input device being remotely disposed from the slave station, the slave station further comprising a mechanically drivable mechanism comprising a shaft having a proximal end, a distal end supporting a tool and a flexible portion between the proximal and distal ends; and

an electronic signal link between the user input device and the slave station, the

command from the input device being communicated via the link for controlling bending of the flexible portion so as to controllably position the tool at an operative site of a subject.

16. The instrument of claim 15, further comprising a plurality of motors coupled to the controller and drivably coupled to the shaft, for controlling at least one degree of freedom of the flexible segment.

17. The instrument of claim 15, further comprising cables extending between the proximal and distal ends of the shaft.

18. The instrument of claim 17, wherein the electronic signal link activates the cables to effect flexure of the shaft at the flexible segment.

19. The instrument of claim 15, wherein the shaft is an inner shaft, the instrument further comprising an outer shaft.

20. The instrument of claim 15, wherein said master station includes a user interface manipulated by a user, and the electronic signal link is provided by a computer system responsive to the user interface manipulations, and the slave station further comprises a drive unit coupled from the computer system to the shaft for controlling actuation of the shaft.

21. A remotely controllable catheter comprising:

a tube having a proximal end and a distal end, at least a segment of the tube being controllably flexible;

a drivable bending mechanism mechanically coupled to and interactive with the controllably flexible segment of the tube; and

a computer remote from and interconnected to the bending mechanism, the computer having a program receiving input from a user, and the program directing the bending mechanism to controllably flex the flexible segment of the tube according to the user input.

22. The catheter of claim 21, wherein:

the bending mechanism comprises a cable extending from the flexible segment and a motor mechanism;

the motor mechanism is interconnected to the computer; and

the cable being driven by the motor mechanism to direct bending of the flexible portion according to the user input.

23. The catheter of claim 21, further comprising a user input device interconnected to the computer, the user input device being remotely mounted relative to the tube and adapted to receive the user input, the program processing the commands capable of directing movement of the bending mechanism according to the user input.

24. A catheter, comprising:

a shaft having proximal and distal ends and at least one flexible segment along a length of the shaft, the distal end being insertable within a body cavity or vessel;

a tool supported at the distal end of the shaft for performing a medical procedure;

at least two cables extending along the shaft between the proximal and distal ends, at least one of the cables associated with the flexible segment of the shaft and at least another of the cables associated with the tool;

an electronic control mechanism drivably coupled to the cables, the electronic control mechanism capable of communicating drive signals from a user input device to the

cables to effect bending of the flexible segment and operation of the tool.

25. The catheter of claim 24, wherein the flexible segment comprises a deformable material, at least one of the cables exerting a pulling or pushing force on the flexible portion of the shaft to effect controlled deformational bending of the flexible portion of the shaft.

26. The catheter of claim 24, wherein the shaft is an inner shaft and the catheter further comprises an outer shaft, the inner shaft being coaxially insertable into the outer shaft.

27. The catheter of claim 24, wherein the flexible segment comprises a coiled section.

28. The catheter of claim 26, wherein the at least one cable associated with the flexible segment is operable to bend the shaft at the flexible segment.

29. The catheter of claim 28, wherein the at least one cable is secured to an outer surface of the shaft between the flexible segment and the distal-most point of the shaft.

30. The catheter of claim 29, wherein the at least one cable extends along the shaft from the secured point to the proximal end.

31. The catheter of claim 28, wherein the at least one cable extends between the inner and outer shafts along the proximal shaft section.

32. The catheter of claim 28, wherein the proximal end of the shaft extends to a mechanically drivable mechanism comprising a first control element for controlling the at least one cable to bend the distal end of the shaft at the flexible segment.

33. The catheter of claim 32, further comprising a second control element that controls rotation of the outer shaft about the co-axis.

34. The catheter of claim 33, further comprising a third control element that controls rotation of the inner shaft about the co-axis.

35. The catheter of claim 34, further comprising a fourth control element associated with an
5 actuating link to control rotation of the tool.

36. The catheter of claim 32, wherein the mechanically drivable mechanism, the shaft and the tool are constructed as a single piece unit that is disposable.

10 37. The catheter of claim 32, wherein the mechanically drivable mechanism engages a receiver which is supported by a carriage, the carriage slideably engaging rails to translate the catheter to and from the subject.

38. The catheter of claim 24, further comprising a user interface, wherein the electronic
15 control mechanism couples the user interface to a drive unit remote from the body cavity or vessel, the drive unit capable of mechanically driving the at least two cables.

39. The catheter of claim 38, wherein manipulations at the user interface control operation of the tool.

20 40. The catheter of claim 39, wherein the tool comprises a pair of jaws and the user interface manipulations control the opening and closing of the jaws.